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CTS OF MACHINERY ON WAGES

J. SHIELD NICHOLSON

1868

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THE EFFECTS OF MACHINERY ON WAGES

THE

EFFECTS OF MACHINERY ON WAGES

BY

oseph

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NEW AND REVISED EDITION

"Die Lohnfrage ist eine Culturfrage."—Brentano

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PREFACE TO THE FIRST EDITION.

In the following pages greater space has certainly been devoted to the evil than to the good results of machinery, and lest I be supposed to hold pessimist views on the subject a word of explanation seems desirable. I observed whilst collecting materials for my Essay, that though many writers of repute had clearly and fully discussed the good effects of Machinery, hardly one had noticed the evils inherent in its use. For example, the veteran economist M. Chevalier devotes quite a third part of his *Cours d'Economie Politique* (first published I believe in 1840) to an elaborate and detailed eulogium of Machinery, but he passes over the dangers, or treats them as if they were of small importance. Instead therefore of attempting to re-write what had been done so well already, I thought it better to give my attention to the parts of the subject

Gift Dr. [illegible] Walkerne 7-57

which had received but little attention, and merely to notice in their proper place the results already fully treated of by other writers. For example, under the heading "Machinery as auxiliary to labour," I thought it sufficient simply to state the two important positions that the increased cheapness in commodities was so far a rise in real wages, and that the enormous increase in our wealth due to machinery must *ceteris paribus* increase the demand for labour, and thus raise wages. Further exposition on this part seemed especially unnecessary since Prof. Cliffe Leslie in his Essay on the course of Agricultural Wages in Europe had demonstrated historically that wages had risen through these influences.

In cases where the good results seemed to me to have been insufficiently stated, I endeavoured to put them in a clearer light; *e.g.* the increase of skill required by machinery and the better distribution of labourers. Still in attempting to make a slight advance on previous writers, and if possible to write what might be of some practical use, I was induced in general to give more consideration to the dangers of Machinery, which appeared to me to have been almost entirely overlooked. The first step towards the amelioration of the evils caused by Machinery is to see distinctly what the evils are. The greatest, I take it, lies in the fluctuations and precariousness of wages, the inevitable result of a system of large industries.[1] In many cases the proximate cause of this evil is over-production, and working-men have not unnaturally rushed to the conclusion that limitation of the supply is a remedy for all their troubles. But this is applying to freely produced commodities the laws which govern monopoly values only. Over-production I have pointed out can only exist "relatively to the demand and the means of distribution," and in this sense is very likely to occur. But it is useless to consider one factor to the exclusion of the others; supply can only be perfectly adjusted by a perfect knowledge of the demand and the means of distribution, both of which depend on a number of varying causes. Let working men, then, instead of attempting the impracticable task of regulating supply, consider the remedies which lie within their reach; in the first place, let them imitate the masters in saving when times are good, and secondly let them use their political influence towards the improvement of international relations, for it is to international disturbances that the most serious fluctuations are due. No operation on supply could have been effective in stopping the over-production consequent on the conclusion of the Franco-German war, but the high wages then obtained might have been saved to a greater extent, and if France had not been under personal government the war might never have occurred.

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[1] See, however, note on p. 65.

My apology for apparently wandering sometimes from the "strictly economic" consideration of the subject lies in my conviction of the truth of Mill's[1] assertion, "that there are perhaps no practical questions, even amongst those which approach nearest to the character of purely economic questions, which admit of being decided on economical premises alone."

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[1] *Principles of Political Economy*, Preface.

J. S. NICHOLSON.

Trinity College, Cambridge,
11 *June*, 1878.

PREFACE TO THE SECOND EDITION.

In its original form this Essay gained, in 1877, the first Cobden Prize given by the University of Cambridge. It was written when I was deeply impressed with the value of the historical method as exemplified in England by Thorold Rogers and Cliffe Leslie, and in Germany by Held, Knies, Roscher, Nasse, and Brentano. Now that death has removed so many of them, my obligation seems all the greater. I am glad that under their influence I was induced at the time to lay most stress on the historical aspects of the problem; for in the detailed search for materials the social history of the era of

Machinery came upon me as an astonishing revelation, and I learned in a way that I can never forget the importance of verifying theories by an appeal to facts.

In the present edition I have made no alteration in the main argument or in the structural arrangement, but wherever possible I have brought the facts quoted up to date and referred to recent authorities. The passages taken from foreign writers have been translated, various technical terms have been explained or abandoned, and generally an attempt has been made to make the work more suitable for the general reader. For many of the alterations I am indebted to Dr. Keynes.

J. S. NICHOLSON.

THE UNIVERSITY OF EDINBURGH,
10 *March*, 1892.

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INTRODUCTION.

§ 1. *Scope and Method.* In any economic inquiry two perfectly distinct methods are possible, and for making choice of one to the exclusion of the other some justification seems necessary. The differences between the two have been expressed in various forms, of which the correlative terms "inductive and deductive" and "positive and hypothetical" seem to mark the implied distinction most clearly. It is true that much has been written to prove on the one hand that the so-called deductive school do not take as premisses[1] "arbitrary figments of the mind formed without reference to concrete existences"; and, on the other hand, it has been urged that so-called inductive writers are really as deductive as their opponents. Again, the positive writers never profess to give all the causes of any social phenomena, and hypothetical writers lay stress on the possibility of disturbing causes which may vitiate their results. But whatever may be said as to the logical identity of the two methods, it cannot be denied that the regulative ideas which dominate them are essentially opposed: the one lays most stress on facts, the other on theory.[1]

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[1] Cairnes, *Log. Meth.*, ii. p. 48.

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[1] Cf. On Method; Mill, *Auguste Comte and Positivism*, pp. 82–86; Brentano, *Englische Gewerkvereine*, 2te Theil, pp. 311–314.

[I have allowed this section on Method to stand as it was written in 1877, partly because it explains the plan adopted in the essay, and partly because the caution implied does not seem altogether uncalled for at present. It is so easy and so fascinating, with sufficient hypotheses and assumptions, to elaborate deductions, especially by the use of mathematical symbolism, that we are apt to forget that the value of the superstructure will depend largely upon the reality of the foundations. The doctrine of utility, for example, treated in this manner, has given rise to some

We may take as an example of the deductive method Ricardo's chapter on the Effects of Machinery on Wages; or, still better, a paper by Tozer published in the *Cambridge Philosophical Transactions* (vol vi.). From their point of view machinery has or has not a good effect on the wages-receiving class according as the *gross* revenue is or is not increased. Now no doubt if their assumptions be granted and disturbing causes not taken into account, the solution obtained is perfectly correct, but it passes over many parts of the problem which have the greatest practical importance; it leaves out of account those effects which

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remarkable paradoxes. At the same time I have no desire to under-rate the advantages of the mathematical treatment of certain problems. The whole question of Method has been admirably treated by Mr. Keynes (*Scope and Method of Political Economy*), and to prevent misapprehension I may say that I entirely agree with him on the uses of different methods for different inquiries.]

working men are actually discussing at the present time; it does nothing, to use Bacon's phrase, "for the relief of man's estate." With this method of course the question appears at first sight to be considered in a far more scientific spirit. The conclusions arrived at apply to all times and places; subject to disturbing causes, it is true, but these are by implication subordinate. As Cairnes says, with practical considerations Political Economy of this sort has no more to do than Geology with coal mines.

The inductive method narrows economic inquiries to certain definite times and places; it looks for its problems in societies either actually existing or which have existed in the historic past, and it considers the legal, social, and intellectual conditions of those societies as important factors to be taken into account. For example, instead of assuming perfect freedom of competition and deducing there-from certain results, it attempts to discover how far in any system of industry competition is free and to investigate the force of actual counteracting causes. The former method has given us the doctrine of the Wages Fund,[1] the latter Brentano's *English Trade-Unions.*

Though fully conscious of the difficulties attending the so-called inductive method, I have ventured to adopt it in the hope that the results obtained, although meagre, may have some bearing on questions which demand a practical solution. In the present condition of Economic History I have found it very often impossible to get in a compendious statement the different classes of facts required, and in some cases I have been compelled simply to indicate positions which demand further investigation. So far as I know, Chevalier (*Cours d'Économie Politique*) is the only writer who has treated the question in all its bearings at all adequately, and he writes in an optimist view which appears to me unwarranted.

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[1] To the Wages-Fund theory and its applications may be traced most of the hostility of working men to political economy. It is proper to mention that the most powerful criticism on that theory has been from the deductive side, as by Professors Sidgwick and Marshall.

Under the conviction however that in investigating the effects of Machinery on Wages it would be more profitable to limit the inquiry to a particular time and country, I have only considered that period of economic history which is known as the era of Machinery, and for the most part only the effects produced in England. This period may be said to extend from the time of publication of the *Wealth of Nations* (1776) to the present day.

Before proceeding to details it is necessary to define what is to be understood by Wages and Machinery, and some discussion of the Wages question seems requisite partly in order to avoid endless repetition, and partly to indicate in what different ways Machinery may affect Wages.

§ 2. *Wages.* "Wages" is usually defined as the reward for any personal exertion, at whatever time and in whatever form received by the labourer. According to this definition, the capitalist who undergoes any intellectual exertion in considering whether an investment will pay receives wages; the "undertaker" (if we adopt Mill's literal rendering of "entrepreneur" and "Unternehmer") receives wages for his exertions in planning work and supervision: clerks, clergymen and schoolmasters all receive wages, and finally the large class of domestic servants and still larger class of labourers hired by employers are also said to receive wages.[1] That a term which includes so much has a meaning which is practically useless in Political Economy, and at any rate would be useless in this essay, seems evident as soon as stated; and in fact writers who have avowedly adopted the above definition have in practice taken a meaning nearer that in popular use. On such a definition the Wages-Fund theory, as held by Mill till near his death, could never have been formulated. It was

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[1] In the General Report of the Census (1881) for England and Wales an analysis is given of the "unoccupied class." After deducting children and young persons under fifteen,

persons over sixty-five years of age, who for the most part had been employed in work of some kind previously, and those between the ages of fifteen and twenty, who might be considered as training for work, there remained 4,641,190 between the ages of twenty and sixty-five without specified occupation. But of these 4,458,908 were women, of whom by far the greater part were married and engaged in the management of domestic life, and thus the number of males in the working period of life (20-65) of the unoccupied class was reduced to 182,223. Thus, practically, nearly the whole of the efficient male population of the country was engaged in some form of "labour," and in receipt of some form of "wages."

only by confining the term "wages" to the two classes last mentioned that the theory could have been enounced. At all events for the present purpose we cannot use "wages" in the large sense indicated above; there could only result endless confusion or most cumbrous phraseology. It would surely be misleading to say that general wages at the commencement of the present era were high because, though some of the labourers received hardly enough to live on, others had for "wages of superintendence" several thousands a year. For the problem in hand it seems best to make avowedly with Prof. Walker, in the most able work on the Wages question in our language, the restriction which Mill makes tacitly, and to define wages as "the reward of those who are employed in production with a view to the profit of their employers and are paid at stipulated rates."[1] Strictly construed, this definition would exclude domestic servants, but labour of this kind is only indirectly affected by machinery.

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[1] *Wages Question*, p. 217.

But if the wages-receiving *class* may be conveniently restricted, it seems impossible in this inquiry to restrict the meaning of "wages" as equivalent to reward in a similar way. On the contrary, I think that the definition should be extended. That is to say, it seems necessary to investigate the REAL not the NOMINAL wages of labour, and to say that wages consist of all the desirable things, using the word "thing" in its widest sense, which accrue to the labourer in virtue of his position as such.

Thus real wages may be said to rise,—although nominally in money they remain the same,—if commodities become cheaper, if dwelling-houses are improved, or even if the habits and tastes of the labourers become more cultivated. At any rate, all will allow that improvements in the sanitary conditions of working and still more any reduction in the hours of labour, although the muscular exertion is proportionately increased, really constitute a rise in wages. As Adam Smith rather naïvely remarks,[1] "The greater part of the people understand better what is meant by a quantity of a particular commodity than by a quantity of labour. The one is a plain palpable object, the other an abstract notion which although it can be made sufficiently intelligible is not altogether so natural and obvious." In determining the rate of wages it is obvious that we must have regard to the "*quantity of labour*," and in any philosophic sense of the term it is clear that a greater quantity of labour is involved in working in an atmosphere stifled with dust and productive of "shoddy fever" than in raising an equal number of foot-pounds in the open.

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[1] *Wealth of Nations*, p. 14 (McCulloch's edition).

Under *quantity of labour* there is included everything in the nature of pain, inconvenience, irksomeness, strain, etc.,—in modern parlance all the disutility involved in earning the reward or corresponding utility. We must especially remember, as Adam Smith says, that there may be more labour in an hour's hard work, than in two hours' easy business; and in general even with this allowance much more than the man's time must be considered. The importance of an adequate conception of a quantity of labour is seen with reference to such problems as an eight hours' day.

Having thus decided what is meant by "wages" in its broadest sense and who receive the wages, it seems desirable to state once for all the position that will be taken up in this essay on the question of the determination of MONEY-WAGES.

The question seems to fall under three heads:—

I. *Between what limits,* if such can be determined, must wages *permanently* remain?

II. How is the *actual point normally* determined?

III. What are the principal causes of *fluctuations* in wages?

I. First, then, what is the *superior limit* above which wages cannot permanently rise? The answer is plain: this must depend primarily on the *efficiency of the labourer.* "The produce of labour," says Adam Smith, "constitutes the natural recompense or wages of labour"; but he goes on to say that this "original" state of things could not survive the accumulation of stock or capital and the appropriation of taxes. If we take the extreme case and suppose that all capitalists should become so philanthropic as to be content with wages of superintendence of no greater amount than that received by most of their employés, it is manifest that if more is constantly distributed than the industry brings in, the capital must gradually dwindle away. This has frequently been the case with co-operative societies for production.

But the efficiency of labour only determines the quantity of a commodity which will be produced; something else must be taken into account, viz. the *money-value of this product.* That money-wages are paid out of the price obtained for the commodity is gradually taking the rank of an axiomatic proposition, the self-evidence of which seems to have been obscured for so long a time by two circumstances. In the first place, ever since Adam Smith laid bare the fallacies of the Mercantile System, any statement of an economic law in a money form seems to have been considered *ipso facto* fallacious: it plainly bore the mark of the beast: if the law were really sound, it should have been stated in terms of cloth and linen: money could only have been introduced to gloss over an error or a difficulty.

In no other way does it seem possible to account for the manner in which, as soon as the inestimable advantages of money as a measure of value in actual commerce have been descanted on, its importance as an explicator of ideas in print was overlooked and everything explained on a system of barter. It is only just to say that this stricture does not apply to Cournot, who always works out his problems in terms of money, which he forcibly compares to the "mean sun" of astronomers. But whatever be thought of this historical explanation, it must be remarked, in the second place, that an important matter of fact has been overlooked or rather looked at in the wrong way: and this again has perhaps arisen from never speaking of the capitalist as having certain funds at his disposal, but a certain command of the necessaries of life. A manufacturer may or may not balance his books at the end of the year, but he certainly does not sell his goods at the end of a year and then got paid: he is *continually* selling and being paid (or at least discounting his bills). The importance of *continuity*[1] in sale and production cannot be overestimated, though of course it is not assumed that it holds of all commodities, when agricultural produce and ironclads are glaring instances to the contrary.

To return from this digression. The first position maintained is that money-wages are paid out of the *money received for the product*, and this amount after allowing for the up-keep of capital and other necessary expenses, is the *superior limit* above which money-wages cannot permanently rise; and that further the amount to be divided plainly depends on the amount produced, which is a function of the *efficiency of labour.* It would be out of place here to discuss the question how the value of one commodity in reference to another is determined; this so far as influenced by Machinery will be discussed later.

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[1] Professor Marshall, in his *Principles of Economics* (see p. 9 *note*, and Preface p. xiv.), has quoted and followed Cournot's example both as regards "money" and "continuity."

The *inferior limit* below which wages cannot permanently fall, is in general given in Ricardo's formula of "*necessary wages.*" Labourers must have enough to live on, or they will not live themselves: and enough to feed their children, or their children will not live.

With regard to *necessary* wages, it is obvious that *necessary* admits of a variable interpretation, according to circumstances, as was long ago pointed out by Adam Smith in his well-known example of shoes—a necessary for English but not for Scottish women. What is really intended is perhaps better conveyed by the phrase, "minimum standard of comfort," because we must also consider causes affecting the birth-rate as well as those affecting the death-rate. The decline in the marriage-rate in recent years points to a rise in the standard of comfort of the great mass of the people.

We must also take into account the effect of the lower limit upon the higher, that is to say of the standard of comfort upon the efficiency of labour, a point which has been very well treated and illustrated by Professor Walker. A man, for example, might live for a long time on two shillings a week, and the consequent degradation might utterly destroy the efficiency of his labour, so that there would not really be more than two shillings to receive.

II. *Secondly,* we must consider the causes which determine what rate, between their extreme limits, will be fixed under normal conditions.

(*a*) That *competition* both as between the labourers themselves and as between the capitalists has a considerable effect, is so evident that the effect was for a long period over-estimated. This competition must again depend partly on the *numbers* of labourers and capitalists, partly on the *mobility* of labour and capital from place to place, and from occupation to occupation.

(β) The capitalist wishes to get as large profits as possible: the labourer will not, if he can help it, let wages approach the lower limit. This diversity of interests, which in practice seems greater than it is—for as Mill long ago pointed out, high wages may mean cheap labour—this supposed diversity of interests leads to a struggle of some kind. The combatants may fight with or without certain legal or social restrictions. Taking "quantity of labour" in the sense given above, as equivalent to all the discomfort involved in working, we see that in England, even at the present day, *law* *and custom* both influence wages. Not to mention the prominent cases of factory legislation, the laws regulating the treatment of sailors and the laws against truck, the slightest reflection shows that the laws relating to education and the Poor-laws have a considerable effect on wages. Again, custom as distinguished from written law is by no means without influence. For instance, it makes a difference whether labourers bargain separately for their wages or combine together and make their agreements in masses.[1] The opponents of Trades-Unions, for example, say their tendency is to make wages unfair, to pay good and bad alike, that they are opposed to piecework, and make other allegations of the same sort, allowing that in these things at least they are to a certain extent successful. Thus it is clear, even on this view, that Trades-Unions have at any rate a considerable effect on wages in particular trades, whether they can or cannot raise them generally, for on the above showing they affect the way in which the "Wages-fund" is distributed. Probably, however, no economist of repute would now deny that Trades-Unions can to some extent raise general wages at the expense of profits.

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[1] This topic has been admirably handled since Thornton's *Labour* called attention to it. See especially Prof. Marshall's *Principles of Economics*, vol. i.

III. So far the Wages question has been regarded solely as a statical problem; it is necessary, *thirdly*, to glance at the causes of *fluctuations* in wages. It was noticed above that money-wages are limited by the price of the product less the other necessary expenses. Experience shows that wages *vary with this price.* We find that wages in a manufacturing district rise and fall almost invariably with the rise and fall of the market for the manufactures produced by that labour. In many cases the fact is recognised by the adoption of a sliding scale.

Thus fluctuations in wages depend on all those complicated causes which give rise to the fluctuations in the price of a commodity. A change of fashion, a distant war, still more a war at our own doors, a change in the mode of production, a good harvest—these, and they are but examples, all influence wages. Thus we get as a general result that Wages depend on a vast complexity of causes which it is impossible to put under one grand law. Several attempts have been made in this direction, the most celebrated of which is the Wages-Fund theory, and the most curious von Thünen's law of $\sqrt{ap}$.[1]

Hence it is evident that Machinery may influence Money-Wages in many ways: it may affect them by operating on the *superior limit*: it may give rise to different relations *between masters and men*: it may increase or diminish the *mobility* of labour: it may or may not increase the *continuity* of employment. But there is still a preliminary difficulty to solve. What is Machinery?

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[1] In this formula a stands for the necessaries of the labourer, and p for the total results of his labour. The natural rate of wages is supposed to be the geometrical mean between these two extremes. *Der isolirte Staat*, ii. 1, 154.

§ 3. *Machinery.* Here, as before in discussing the definition of Wages, we shall find it the simplest plan to fix the meaning of the term by considering its denotation, that is to say, the things which it includes. We could of course say broadly that by Machinery we mean any mechanical contrivance which is auxiliary to labour. But in this way we should include the simplest tools and contrivances, even those in use in prehistoric ages; and this would be to discuss the question on abstract grounds, whilst it was distinctly stated at the outset that the aim of the present essay was to trace the effect of those aids and substitutes for labour characteristic of the present age, and to contrast the effects of complex Machinery and of simple tools. Still the distinction aimed at is not altogether the same as that indicated by Babbage[1] as existing between *making* and *manufacturing*: it is rather my intention to consider those characteristics of Machinery, using the word in its widest sense, that have in any way influenced Wages during the present era, leaving out of account or only introducing by way of contrast those appliances to which labour had before adapted itself, those which had, so to speak, become permanent in the industrial economy of the previous era.[2]

What then are these characteristics of Machinery which are to be considered? Manifestly for the present purpose it would be of little service to describe, as Babbage does, the different kinds of machines and classify them. The only fruitful method seems to consist in considering in detail the different *ways* in which Machinery may affect wages as alluded to above. It is true that this mode of procedure involves a certain amount of repetition, but the advantages of looking at the subject from different points of view seem so great as to overbalance this inconvenience. When above I speak of confining the subject to the present era, I must not be understood to imply that, to use a mathematical term, I shall only consider the *dynamics* of the subject, *i.e.* the momentary effects of new inventions; for I think it no less important to discuss the conditions under which our industry has come to be carried on, and which may for the present at least be considered *stable* or rather *statical*.

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[1] Babbage, *Econ. of Mach. and Man.*, p. 100.

[2] In the same way, in discussing Ricardo's theory of Rent we may consider improvements in land after a certain time as parts of the "original and indestructible powers of the soil."

After making trial of various different methods of dividing the subject, the following division has been adopted, the justification for which can only appear in the sequel.

I shall accordingly proceed to treat Machinery as affecting Wages in the following ways:—

I. As a *substitute* for labour.

II. As *auxiliary* to labour.

III. As affecting the *division of labour*.

IV. As *concentrating* labour and capital.

V. As affecting the *mobility* of labour and capital both from place to place and from occupation to occupation.

I must request the reader to bear in mind that throughout this essay I use the term Wages in the large sense defined above, as including everything desirable obtained for the work done. I also use the term Quantity of Labour as a convenient expression for all the discomforts, efforts, strain, or disutility which the labourer is obliged to undergo to obtain this net reward. It is plain then that real Wages may be said to rise either through an increase in the reward or by a diminution in the quantity of labour involved.

Very often, no doubt, the most important and always the most obvious element in Wages is the money received, and in quantity of labour the number of hours' work done; but in treating of a period which has witnessed such vast changes in production and organization, it is clear that many other factors are too important to be neglected.

CHAPTER I.

EFFECTS OF THE SUBSTITUTION OF MACHINERY FOR LABOUR.

In this chapter I propose to investigate simply the *immediate* or *closely proximate* effects of the substitution of machinery for labour. It has generally been acknowledged that as labourers are paid out of circulating capital any increase of fixed at the expense of circulating capital must *pro tanto* temporarily injure the labourers. It is indeed self-evident that if a machine does what was before done by men, the immediate effect, with which we are here alone concerned, is to throw those men out of employment. Chevalier puts very well this objection to the introduction of machines: If by the aid of machinery you can do with one workman the work that formerly required ten, you throw nine on the street. The usual answer, Chevalier's included, is to lay stress on the *temporariness*, and to assure workmen that eventually machinery does increase the number of men employed. The validity of this answer must depend entirely on the meaning given to the word "temporary." It is a small consolation to a working man to be assured that in a year's time he will have plenty of work, if in the meantime he must remain breadless. Loss of work even for a few weeks may exhaust his credit and the affection and means of his friends, and there may remain nothing for him but starvation, unless poor-laws or private charity come to the rescue. Thus it is clear that "temporary" must be interpreted in reference to the general position of the labourer. If he has accumulated a little money, he may emigrate; if he is intelligent, he may discover there is work for him in another part of the country: but supposing he has neither funds nor friends, and has no knowledge worthy of the name except of a few square miles in his immediate neighbourhood, if he looks upon the workhouse in the light of a prison, and his narrow intellect sees nothing in the future but misery and starvation, then, to such an one the introduction of machinery is and must be an evil. In order therefore to solve the problem for the immediate future of a change, it is worth while attempting to discover the law, if there be one, of the introduction of machinery on the one hand, and on the other what causes tend to increase the *mobility* of labour, under which expression all remedies for the immediate evil seem to fall.

The importance attached to this aspect of the question has arisen from the supposition (which itself depends mainly on a misinterpretation of the events which occurred at the commencement of this century) that a sudden introduction of machinery on a large scale might possibly happen. If however it is found that in the literal sense of the words such a thing is almost impossible, and that both the suddenness and the extensive adoption of improvements tend to diminish with the progress of society, results founded on the supposition are of little interest and no value, and we may turn to characteristics of greater importance. I am quite aware of the truth which Jevons[1] allows in treating of the progress of invention from another point of view, that "the extension of the sciences and the arts is the last thing that can be subjected to rigorous laws." But I also hold with him that "in a long course of progress, like that which marks the rise of civilization in England, we may observe tendencies, not free from exception, of an instructive kind." The law or tendency which, as I read it, History reveals, is —[1]

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[1] Jevons, *Coal Question*, p. 68.

I. That a radical change made in the methods of invention will be *gradually and continuously adopted;* and

II. That these radical changes, these discontinuous leaps, tend to give place to advances by small *increments of invention.*

I. Suppose in the first place that a radical change is introduced by some ingenious producer into a certain manufacture, which will lead to the employment of less labour. That this invention will be adopted in process of time by all other manufacturers is evident, but I maintain that in comparison with the mobility of labour the change will be slow.

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[1] For other examples of the principle of continuity, see Cournot's *Revue Sommaire*, e.g., p. 177, where he quotes "Natura non facit saltum," which Prof. Marshall has taken for the motto to his *Principles* (q.v. *passim*).

We have an instance of radical change in the steam-engine. Watt's patent for a "method of lessening the consumption of steam and fuel in fire engines" was published Jan. 5th, 1769, and it may be said that the movement of substituting steam as a motive power is not yet over. Every day we hear of steam being extended to some new employment, and to some out-of-the-way district.

The history of the power-loom again shows that the adoption of an invention is comparatively slow. In 1813 there were not more than 2,400 power-looms at work. In 1820 they were increased to 14,150. In 1853 they were 100,000. But the important thing to notice is that in this time the number of hand-looms had *increased* rather than diminished.[1] A striking instance occurred as I was writing this essay (1877). "The introduction of machinery into the watch manufactory of Switzerland must, it is feared, have a disastrous effect on those engaged in that industry. In the cantons of Neufchatel, Geneva, and Berne there are, it is estimated, about 40,000 men and women engaged in watchmaking, and the division of labour has been applied to such an extent that 120 persons are required to produce a complete watch. Each person makes in one year about 40 watches, or one in nine days. Considering the fact that an American factory hand turns out 190 machine-made watches per year, and that 1,000 workmen can make 366 watches per day, it is evident that changes must occur in the Swiss watch trade. If the Swiss employers introduce machinery and the demand for their watches remains as it is, they could afford employment to only 8,400 persons instead of 40,000 as at present. Should they continue to employ hand labour there will be a rapid decline in their trade. It cannot however be reasonably supposed that the *effects will be so sharp and decided.* Watch-making machinery is costly, etc."[1] There was I believe at this time only one large manufactory for watches by machinery in England: and it was clear that the adoption of machinery must be gradual.[2]

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[1] Porter, *Progress of the Nation*, p. 186.

The more enterprising the capitalist the sooner he will make any change, but the change will not in reference to labour be sudden. In the instances quoted above, the workmen so to speak receive timely warning, and could prepare against the evil. However highly organized a society becomes, changes of a radical kind are met with a good deal of resistance. There is the expense involved, there are the vested interests to overcome, there are the customs and prejudices of customers, and above all there is the intelligence required in the capitalist.

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[1] *Capital and Labour*, vol. iv. p. 77.

[2] Prof. Marshall (*Principles*. 2nd edit., p. 316) writes that this Swiss industry is *now* (1891) yielding ground to the American system.

That the change must come there can be no doubt, but that it will come comparatively slowly and give the workmen time to get other employment is no less true. The change will at first be adopted by some enterprising capitalist in the centre of a highly competitive region, and will gradually extend to the manufactories of less competent masters in more remote districts.

II. But secondly the law as stated asserts that *inventions* tend to become more *continuous*, to advance by "little increments," not by leaps. For instance, even in the infancy of power-loom weaving, where we might have expected greater rapidity, we have only gradual improvements. This is clearly shown by Porter.[1] "A very good hand weaver 25 or 30 years of age will weave two pieces of shirting [of specified quality and dimensions] per week. In 1823 a steam-loom weaver about 15 years of age attending 2 looms could weave 9 similar pieces in a week. In 1826 a steam-loom weaver about 15 attending to 4 looms could weave 12 similar pieces in a week, some 15. In 1833 a steam-loom weaver from 15 to 20, assisted by a girl of 12, attending to 4 looms could weave 18 pieces." Certainly in one way the changes here noticed are rapid, but changes can with regard to labour only be called sudden with reference to the mobility of labour. The progressive character of invention might be illustrated *ad infinitum.* As Porter remarks,[1] "It would fill many large volumes to describe the numerous inventions which during the present century have imparted facility to our manufacturing processes, and given perfection to the articles made." There is however one striking proof of the gradual development of improvements. Notwithstanding the chaotic condition of our Patent Laws and the expense connected with them, no less than 5,000 patents are annually registered in England.

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[1] Porter, *Progress of the Nation*, p. 183.

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[1] *Ibid.*, p. 266.

Examination shows that nearly all are minor discoveries. A friend informs me that in many manufactures in this country, improvements are made which it is considered not worth while to patent, but for which the discoverer is amply rewarded by the manufacturer. An article in the *Scientific American*[1] traces the progress of American invention with similar results. Thus "out of 2,910 patents issued in the year 1857, 152 were for improved cotton gins and presses, 164 for improvements in the steam engine, and 198 for novel devices relating to railroads and improvements in rolling stock."

Results of the Law of Continuity. This doubly progressive nature of invention operates in favour of the labourer in two ways. In the *first* place, in all probability the *market* by the increased cheapness of the commodity consequent on the use of machinery *will be extended pari passu* with the improvements, and thus the workers will not be thrown out of employment even temporarily. And in the *second* place, supposing there is no extension of the market, the labourers may be absorbed in other employments, or emigrate when the change is not very sudden and extensive. In this they are favoured by everything which tends to promote the *mobility of labour,* and apart from the increase with civilization of the education of the working classes attention will be drawn to the fact in the sequel that machinery has above everything increased this mobility.

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[1] Quoted in *Capital and Labour*, May 9, 1877.

So far the question relating to the introduction of machinery has been discussed entirely from the orthodox standpoint: the working class has been spoken of as composed of similar units, and we have considered simply the effect of substitutive machinery as "momentarily" throwing them out of employment.

In the short investigation, however, which it was necessary to make concerning wages it was seen that the determination of wages (between certain limits) depends partly on the *relations existing between masters and men,* and we have now to consider whether the introduction of machinery makes any alteration in these relations, and further we have to examine the effects of machinery in changing *the character of the labour required.*

We must consider the labouring class no longer as consisting of a definite number of similar units but of an indefinite number of sub-classes with more or less conflicting interests.[1] It is at any rate quite clear that the mere conversion of circulating into fixed capital is only one element, probably a minor element, in the problem as it was worked out at the commencement of this era.

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[1] In 1881 the Census authorities found it necessary to make a new dictionary of the names of occupations. See General Report, p. 26.

The history of all our textile manufactures shows that the improvements in machinery, by cheapening production and thus extending the market, *gave employment to an ever-increasing number of hands,* and yet with the apparent prosperity, *the condition of the working classes got worse and worse.* Take for example the cotton industry: it was shown by Babbage[1] that between 1822 and 1832 the total number of workmen increased about one-third, while the amount of manufactured goods was, owing to improvements in machinery, three times as great as before. But he goes on to say, "in considering this increase of employment it must be admitted that the 2,000 persons thrown out of work are not exactly of the same class as those called into employment by the power-loom. A hand-weaver must possess bodily strength which is not essential for a person attending a power-loom: consequently women and young persons of both sexes from 15 to 17 years of age find employment in power-loom factories." He concludes by saying that "during the whole of this period the wages and employment of hand-loom weavers have been very precarious."

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[1] Quoted in *Prog. Nat.*, p. 196.

The same result is arrived at by Brentano[1] in a detailed examination of all the chief industries of the country after they were disorganized by the introduction of machinery. It was not because *fewer* hands were employed, but that apprentices were employed instead of journeymen, and women and girls instead of men. *Skilled labour of a certain order became valueless,* and if machinery called into being skill of a different kind, that skill was *not fixed*

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[1] Brentano, *Gilds and Trades Unions*, part v. (Eng. edit.).

and embodied in the same labourers as before. This destruction of the labourer's only capital is one of the most pernicious effects of machinery, and when it happens there is and can be no remedy. Still if the changes are gradual the evil consequences are not so great, so that here again we see the importance of the Law of Continuity.

A radical change in the production of wealth involved a no less radical change in its *distribution,* and the latter was no less injurious to the working classes than the former. First of all the Statute of Apprentices fell into disuse. Under this statute, according to Brentano, "the position of the workmen was secure. The long term of service assured them the regularity of employment which they desired above everything. The magistrates were, according to the directions of the Act, to assess the wages so as to yield unto the hired person, both in the time of scarcity and in the time of plenty, a convenient proportion of wages. The restrictions as to apprentices prevented a too great competition from lowering the skilled workmen to the level of common labourers."[1] The introduction of the factory system, which was necessarily involved in the employment of machinery, destroyed all these restrictions on self-interest. *Laissez-faire* ruled supreme. The old laws inevitably repealed were not replaced by new; and combinations on the part of the workmen, by which alone they could cope with the masters, were expressly forbidden.

Again, the *conditions under which the labourers worked* rendered that work far more exhausting. They worked in an atmosphere poisoned with dust, worked for such long hours that it seems marvellous their race was perpetuated. Wages fell only more and more with the degradation of labour, while the "quantity of labour"—the misery of toil—rose. Children began to work in factories at five years of age, and worked the same hours as adults.

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[1] Brentano, *Gilds, etc.* (Eng. ed.), 104. Thorold Rogers (*Six Centuries of Work and Wages*, p. 353) severely condemns this statute. It is certain, however, that the labourers petitioned against its repeal.

"They look up with their pale and sunken faces,
And their looks are sad to see;
For the man's hoary anguish draws and presses
Down the cheeks of infancy.

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For all the day, the wheels are droning, turning,
The wind comes in our faces,
Till our hearts turn, our heads with pulses burning,
And the walls turn in their places.

Turns the sky in the high window blank and reeling,
Turns the long light that drops adown the wall,
Turn the black flies that crawl along the ceiling,
All are turning, all the day, and we with all.

And all day the iron wheels are droning,
And sometimes we could pray,
'O ye wheels' (breaking out in a mad moaning),
'Stop! be silent for to-day.'"

England's apparent prosperity was like the luxurious vegetation which rises from the poisonous swamps of the Tropics: at a distance, to the casual observer, her trade throve and prospered, but below it rested on the absolute misery of thousands of her inhabitants. It is not requisite here to re-write this saddening page of our history, to recite once more in detail "the crimes committed in thy name, O Liberty!" They stand recorded in Parliamentary reports: they provoked the scorn and indignation of Byron, and moved by them, England's greatest poetess wrote her finest lyric.

How this state of things was gradually remedied may be read in the pages of Ludlow and Lloyd

Jones: how machinery, like a tamed wild beast, was made to contribute to this good work has been well told by Edler von Plener (*History of Factory Legislation*). For it is a curious fact that in ameliorating the condition of the labourers machinery played an important part. It was only by the introduction of machinery that manufacturers were enabled to carry out the provisions of the Factory Laws without lessening the numbers or reward of the labourers. Thus machinery was, through legislation, *directly beneficial* to the labourer.

It has been too often assumed, under the influence in some shape or another of the theory of "necessary wages," that the capitalist and the "consumer" are the only persons who can be benefited by improvements in production, that the capitalist who first introduces machinery will at first get larger profits, but that competition will finally transfer the benefit to the "consumer," and if the labourer is to be benefited at all by machinery it is in his capacity of "consumer." The fallacy of looking at the question entirely from the consumption point of view is well expressed by Mr. Thompson,[1] one of the National Economists of America. "He (the consumer) is an innocent *ens logicum* manufactured by the same process of abstraction by which the economists derived their economic man, 'a covetous machine impelled to action only by avarice, and the desire for progress.' That is, they cut away or stole away (abstracted) the better half of the real being, and persisted in treating the remaining human fragment, if we can call it human, as a living reality." This language is perhaps rather too rough and vigorous, but the writer may be excused if we consider the simple fact that the great majority of our population are labourers in the strictest sense of the term, and are engaged in *production* on the average ten hours every day of the year. Surely it is clear that under these circumstances an improvement in the conditions of the labourer's work may be of far greater importance than an increase in the reward he receives. Cheap calico and plenty of it is a good thing, but moderate hours of labour, a healthy atmosphere, freedom and education for children, are infinitely more important. Wages may rise as already explained either by reduction of the quantity of labour or by an increase in the reward. And in the case I am now considering the former element was operated on by the introduction of machinery.

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[1] *Social Science and National Economy*, p. 269.

Mill himself has indeed alleged that labour-saving inventions have not lightened the toil of any human being : they have only enabled a greater number to live the same life of drudgery and imprisonment. Yet what is more natural than to suppose that other things remaining *in statu quo* improvements in production might be turned to the improvement of the condition of the labourer as producer? Now not only is this supposition quite possible in theory, but it has actually happened in fact. When factory legislation was first attempted, the manufacturers offered a most vigorous resistance: they extolled the advantages of free competition; they appealed to "the fundamental laws of political economy"; they made sneers at paternal government; they insisted on the right of a man to be free; they said such legislation was an indignity put on the human nature of both masters and men: all these things they offered as reasons for their opposition, but that opposition was really founded on another economic law. For this factory legislation "appeared to threaten them with a serious loss, both through a diminution in the number of goods manufactured and an increase of expenditure."[1]

That class legislation may be carried too far, that paternal government is at best the lesser of two evils, that self-reliance is an inestimable blessing worth some sacrifice to attain, are propositions in political philosophy too obvious to be disputed: nay more, I would say, they require to be specially emphasized at the present day.[2] But by 1840 ample time had been given to *Laissez-faire* to develop freedom and self-reliance, and what had been the result? The feelings between the labouring and employing classes had become more and more embittered, and the old reliance on Law had been replaced in the workmen by the new reliance on Trades-Unions.

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[1] von Plener, p. 96.

[2] More so now than in 1877, to which the "present day" originally referred.

But with such vast evils as were alluded to above, Trades-Unions were as unable to cope as was free competition. Hence in the determination of a "reasonable natural wage" in the sense in which "wages" has been used throughout this Essay, *legislation was absolutely necessary.*

How this legislation improved the condition of all parties concerned is recorded in von Plener's History[1] already referred to, a work which but for the nature of the subject-matter might be called dry and uninteresting, so little is the historian moved by aught but facts. "When," he says, "the masters had learned to bow before unavoidable necessity, they endeavoured to regain in the ground of the law what they were in danger of losing by its being acted upon. In order to produce in the shorter working day the same quantity of goods as hitherto, the system of working had to be made more productive of greater results. This could be done in two ways: first by an increased amount of work done by the operators, and next by the *introduction of better and faster machinery.*" Again he writes (p. 98), "The reduction of the working day could only be balanced by an *increase of productiveness through the machinery,* and though the astonishing progress of machinery in the first half of the present century . . . was to a great extent caused by the general condition of production, it is an indisputable fact that it was factory legislation which gave the direct impulse to the introduction of the time-saving machines."

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[1] von Plener. *Hist. Fact. Leg.*

Thus once at least in our history the introduction of labour-saving machinery directly saved the labour of the labourer and thus raised his real wages.[1] It is true that commodities did not become so cheap as they might otherwise have done, but it must be remembered that the greatest number of consumers are taken from the labouring class, so that in this instance the "consumer" gained in his capacity of producer.

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[1] It is very remarkable that in the evidence of the

Similarly Brentano has noticed that when improvements are made in machinery, the Unions try to gain all the advantages, and in certain conditions this seems justifiable.

The Statical Problem. So far I have considered the immediate consequences of the introduction of machinery, or more properly of the transition from

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Factory Inspectors before the Labour Commission now (1892) sitting, it is stated that the labourers themselves do all in their power to warn the masters when the inspectors are coming, and to conceal any infringement of the Factory Acts. To whatever cause this hostile attitude of those most benefited is to be attributed, it emphasizes the need for factory inspection, especially in the interests of children.

one mode of production to the other. But if we suppose the industrial organization of society to have become stable, we may still examine the effects of machinery as one of the most important factors. It is accordingly necessary to examine the question as one of economic *statics,* and first of the effects of machinery as auxiliary to labour.

CHAPTER II.

MACHINERY AS AUXILIARY TO LABOUR.

A useful distinction was drawn by Richard Jones[1] and has since been generally adopted between auxiliary and sustaining capital, and a similar distinction may be made between the *labour-saving* and *auxiliary* characters of machinery. Not only does the actual introduction of machinery as a substitute for labour affect wages at the moment, but the fact that man's labour is increased in efficiency by mechanical aids has important bearings on the reward of that labour.

And first of all, we may just glance at the tremendous increase in the efficiency of labour which arises from the use of machinery. Chevalier[1] has made some interesting investigations on the productive powers of this century, compared with those of an earlier period. His results are of course very rough, and still greater changes have been made since the work was written (1840), but they present the matter in a startling way. For instance, he deduces that *one* workman performs at the present time (1840), in spinning cotton, an amount of work equivalent to that of 320 men before 1769. In a note[2] appended to the last edition (1855), he says that, owing to subsequent improvements, the ratio should be expressed by 700. Striking as Chevalier's results are, however, they pale before those obtained by Dr. Engel (quoted in *Economist*, March 10, 1877). "The aggregate steam power in use in the world is at present $3\frac{1}{2}$ millions horse power employed in stationary engines, and 10 millions horse power in locomotive engines. This force is maintained without the consumption of animal food, except by the miners who dig the coal, and the force maintained in their muscles is to the force generated by the product of their labour as 1 to 1,000. This steam power is equal to the working force of 25 millions of horses, and a horse consumes three times as much food as one man. The steam power is therefore equivalent to the saving of food for 75 millions of human beings. Further, three power-looms attended by one man produce 78 pieces of cotton fabric, against 4 pieces produced by one hand-loom worked by one man in the year 1800. A carpenter's planing machine does the work of 20 men. A McCormick's corn reaper doubled the grain produce in the United States by enabling the available labour to harvest the extended crops."[1]

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[1] *Lit. Rem.* (edit. Whewell), p. 63. Cf. Bagehot, *Postulates II.*

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[1] Cf. Hearn, *Plutology*. 170. Babbage, *Econ. Man.* 6.

[2] Chevalier. *Cours d'Écon. Polit.*, i. p. 319.

I. The most obvious result of this wonderful decrease in the expenditure of human toil in producing commodities, is that these commodities fall in price. This fall means, *ceteris paribus*, a *rise in wages*, i.e. real wages. Even supposing the labourers, by excessive multiplication of numbers and competition, reduced their wages to anything approximating to the "necessary wages" of Ricardo, they would still gain by the increased cheapness of commodities; for any economy of necessaries,—and some economy is always possible,—gives an increased command over luxuries. This result is so obvious in itself, and has been developed to such an extent by all the optimist writers on machinery, that it seems unnecessary to dwell on it further. Definite tables of the relative values of corn and manufactures at different periods have been obtained by Thorold Rogers and Young (*Labour in Europe and America*); and that the working classes can, if they choose, buy these luxuries, is shown by the amount of alcoholic liquors annually consumed by them.

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[1] See Dr. Engel's later work, *Das Zeitalter des Dampfes*, for a mass of interesting facts.

II. *Increase of productive power* necessarily involves, human nature remaining the same, *increased accumulation of capital*, and as Adam Smith[1] observed, "It is not the actual greatness of national wealth, but its continual increase, which occasions a rise in the wages of labour. It is not accordingly in the richest countries, but in the most thriving, and in those which are growing rich the fastest, that the wages of labour are highest." The increase of wealth in England, for instance, in this century, has been enormous: and, unless the industrial conditions attendant on the present modes of production have given more power to the employer than the employed in the question of distribution, it is evident that the wages-receiving class must have benefited. That they have done so, is shown partly by their savings (in Savings Banks, etc.), partly by their consumption of luxuries. Here again it seems unnecessary to go further into detail, for the proposition maintained is simply that part of the Wages-fund theory which has never been contradicted — the more circulating capital there is engaged in a trade, the higher, *ceteris paribus*, will wages be.

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[1] Page 31 (McCulloch edit.).

III. So far nothing but good seems to result from the use of the auxiliary machinery, but serious evils have been pointed out as inherent in the large system of production, and these must be carefully considered. The power of machinery is from one point of view *too* great and continuous: machines breathing fire and smoke, those slaves of iron and steel, as Cournot calls them, can go on night and day at high pressure. Hence results the tendency of machinery to add enormously to the toil of the labourers by increasing the day's labour both in *length and intensity*. Trades-Unions often object to piecework because, to use a rowing phrase, the best men set too fast a stroke for the comfort of the average workman, but the strength of the strongest is as water compared with the strength of machinery. This objection to machines has been forcibly stated by Chevalier[1]: "Machinery imposes on man a crushing task. Feeble appendage of a mighty force, a tiny engine bound to an engine of immense power, the workman must bow to its attractions, give way to the rapidity of its movements, follow it in its incessant pace—in a word, he must turn, twist, and toil just as much as the untiring machinery pleases." Experience shows that the objection thus stated should not be dismissed, as Chevalier contemptuously does, with the comment that it is pure rhetoric.[1] The following facts from Robert Owen[2] may be added to those given above under "Substitution," on the excessive hours of labour produced by the use of machinery: "As a rule we find children of 10 years old worked regularly 14 hours a day, with but half an hour's interval for the midday meal, which was eaten at the factory. . . . In some cases mills were run 15, and in exceptional cases, 16 hours a day with a single set of hands, and the owners do not scruple to employ children of both sexes from the age of eight." It is not necessary to repeat what was said above on the necessity of factory legislation; fortunately we seem to have approached the limit of Government interference, and amongst the masters a better state of feeling has grown up in relation to their workmen.

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[1] *Cours d'Écon. Polit.*, i. 366.

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[1] See note at the end of the chapter.

[2] Ap. Young, *Labour Eur. and Am.*, p. 180, note.

IV. But another danger of an entirely opposite kind lurks in this immense power of machinery, which is continually showing its reality, and remedies for which will, it is to be feared, be the fruit of long years of tentative adaptation to the new environment.[1] What all sensible working men desire, what the advocates of the Trades-Unions say is their chief object, is to get a "*steady sufficient wage*," but it has been proved inductively that great *fluctuations* in price occur in those commodities which require for their production a large proportion of fixed capital. These fluctuations in prices are accompanied by corresponding fluctuations in wages and irregularity of employment. But fluctuations in wages and discontinuities in employment are two of the greatest evils which can befall the labouring classes. To show that the dangers here alluded to are not fanciful, it will be necessary to examine briefly the theory of over-production.

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[1] This is the principal point in the essay which I have modified most, and which I am inclined to modify still more. Judging from the Labour Returns compiled by Mr. Burnet for the Board of Trade, the average of unemployed during the year of representative Trades-Unions seems to be only from 3 to 4 per cent., and to a considerable extent this is accounted for by strikes. The reports of fluctuations in wages in many industries seem also exag-

In a celebrated chapter of Mill's *Principles*[1] it is maintained that a general excess of supply, or, in other words, general over-production, is impossible. Mill allows that there may be over-supply in the

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gerated. I have treated the general question in a separate paper. (See *Economic Journal* for June, 1892.) Compare, however, Prof. Foxwell's Essay on *Irregularity of Employment and Fluctuations in Prices.*

[1] Bk. iii. ch. xiv.

case of any one commodity whatever, with the consequence that the producer or the dealer may suffer loss or inconvenience, but he denies that there can be a similar over-supply of all commodities. His argument is an interesting piece of deductive reasoning, and also a good example of the merits and defects of that method. Briefly stated, it is as follows. Demand depends upon two elements—the desire to possess, and the means of purchase. If therefore there is an excess of supply over demand, it must be owing to a deficiency in one or both of these factors. Suppose first that there is no deficiency in desire, then, says Mill, there can be no deficiency in the means of payment, because commodities pay for commodities. Buying and selling, demand and supply, are in the last resort reciprocal in their action. The more commodities there are to sell, so much the more are there also to pay with, for all exchange is ultimately barter. Thus there can be no difficulty, through general excess of supply, in the means of payment. Next consider the other element in demand, namely, the desire to possess. Here Mill is obliged to admit that it is abstractedly conceivable that more *might* be produced than people would desire to consume, but then he maintains that the mere fact that people go on producing shows that they wish to exchange their produce, that is to say, that they wish to demand other commodities.

Now, there is no doubt a basis of truth in this general argument that is too often overlooked. Commodities in the end pay for commodities, and producers are also consumers. The greater the annual production or supply so much greater will be the annual consumption or demand.

At the same time, however, to men of affairs this denial of the possibility of general over-production can never appear other than paradoxical;

and in the language of theoretical economists the disturbing causes are of greater importance than the original hypothesis.

And it must be observed that Mill lays stress on the importance of his conclusions practically. "The point is fundamental," he writes; "any difference of opinion on it involves radically different conceptions of political economy, *especially in the practical aspects*." Here, it seems to me, we have one of the most striking examples of the dangers of the deductive method. Mill thought he had taken into account all the elements of the question, and in the face of facts, and in spite of verification, spoke of the opposite doctrine of Sismondi, Malthus, and Chalmers, as self-contradictory, and a fatal misconception. And yet the element overlooked is so obvious, that Chevalier, who is, however, not fully aware of its importance, does not think it requisite to go to the trouble of proof.

"Industry on a large scale was born yesterday, and like all social forces in process of development is badly organized." If capital and labour possessed perfect mobility, if they could be transferred immediately from one employment where they are not wanted to another where they are, if all the commodities manufactured could find perfectly organized markets where they could be exchanged at once, and if no other "disturbing" cause interfered, then Mill's doctrine might be not only true hypothetically but be of great value in its "practical aspects."

It is curious to note that Mill himself, in attempting to explain how such an "irrational" doctrine (viz. that of general over-production) could have been supported, makes the remarkable admission that in times of commercial crisis there is really an excess of all commodities above the money-demand. But he forgets that demand means demand at a price, and that the only effective demand is the money-demand.

Certainly the question of over-production is one of the most important in Economics, and owes its origin, as Sismondi pointed out, to the introduction of machinery. Take, for example, the condition of industry in 1876. The restricted confidence, the rigorous application of reduction and economies, lessened wages, and failures of numberless commercial and manufacturing concerns, were mainly due, according to the Commercial Review of that year, in the *Economist*,[1] to the over-production which ensued after the Franco-German war. No doubt this over-production began in the coal and iron trades, but it did not end there; industry is now so sensitive that what affects one branch *ipso facto* affects all the rest. I do not think that what some people call "gluts" are due entirely to the existence of machinery, or are even inherent in its use; credit, free trade, and political influences are important factors, but still it is undeniably true that but for the tremendous powers of machinery, a great depression of trade would not be so long or severe. Machinery operates in two ways.

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[1] Issue of March 10, 1877.

In the *first* place, "when supply is overtaken by the demand, prices fly up out of all proportion to the deficiency,"[1] and as a consequence machinery is put to its greatest productive use, so that the capitalist may make hay while the sun shines. Wages rise, and if it is an important branch of industry such as coal or iron, the number of men employed makes an appreciable difference in the demand for other commodities. The demand may not be very greatly in excess of the normal demand; that makes no difference, prices will fly up all the same, and masters will strain every nerve to realize the consequent high profits. But when supply is found to have more than satisfied the demand, there is a tendency to depress prices just as disproportionately. Wages are reduced; a general depression ensues, and then the *second* effect of machinery appears. The capitalist cannot afford to let his machines stand idle, for then he will not only lose his "minimum of profits" but the machinery itself will deteriorate, and when another revulsion occurs he will not be able to get back his old hands. Thus the *continuity of employment* caused by machinery is not altogether so advantageous as has been supposed: only part of the labourers are employed at reduced wages, and their employment only *prolongs the depression.*

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[1] *Ration. Mark. Fluctns.*, p. 12.

It does not seem necessary to discuss further under this division of the subject the fluctuations and precariousness of wages to which machinery has given rise: the question will be further discussed from the point of view of the distribution of industries.[1]

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[1] The following from the *Cotton Factory Times* illustrates very forcibly the influence of machinery in setting too fast a pace:—"We have frequently heard spinners in cotton mills talk about being worked up, and made such that they could neither enjoy food nor rest, and their lives felt a burden to them, and after leaving the mills at night they can be seen wending their way to places where they can quench their thirst, and liquids take precedence over food, which the appetite does not call for when the human system is overworked and overheated, and the mind greatly disturbed by the difficulties and hardships which surround the workmen in their employments. It is quite a common occurrence to hear young men who are on the best side of thirty years of age declare they are so worked up with the long mules, coarse counts, quick speeds, and inferior material that they are fit for nothing at night only going to bed and taking as much rest as circumstances will permit. There are few people who will credit such statements, nevertheless they are true, and can be verified any day in the great majority of the mills in the spinning

districts. The system of competition which prevails between managers in the different mills as to which can turn off the greatest number of hanks per spindle for the same counts of yarn, has led up to the practice of driving, and the men and their piecers are compelled to keep up with the never-tiring machinery, or fall behind in the quantity of work required from the mules, and they know what that means; hence, to avoid the exposure and threat which usually follows a reduced production of hanks, the spinner and his piecers are induced to work past their strength, and it is in this manner they are thoroughly done up when they leave their work in the evenings. There is some truth in the statement about young men being worked up, as it was stated the other week at a meeting of the Oldham Board of Guardians that there was not sufficient accommodation for the rapidly increasing number of inmates, caused through workmen being worked up in their system when at the age of forty to fifty years, and those who had not been able to save money found their way to the workhouse. Such information, coming from guardians of the poor, confirms the statement that young men are now worked up much earlier than formerly, and from what we can observe the evil is likely to increase rather than decrease, as the industrial strife between nations is sure to become keener as time rolls onwards. Therefore it behoves workmen generally to make the best use of their opportunities while in a position for doing so, to provide against the evil day, and not squander their earnings in a foolish manner."—*Cotton Factory Times*, 5th Feb., 1892.

CHAPTER III.

MACHINERY AS AFFECTING THE DIVISION OF LABOUR.

ONE of the most obvious results of the employment of machinery is the ever-increasing subdivision of labour, but the consequences of this subdivision as regards wages are not so self-evident. It will be most convenient to consider this part of the subject under two heads: (i.) in relation to the *quantity of labour*[1] involved in a day's work under the new system as compared with the old; (ii.) in relation to the *reward* obtained, quantity of labour being supposed constant.

I. *Division of labour as affecting quantity of labour.*

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[1] For the full explanation of this phrase see pp. 11, 12, 26.

Some economic writers have supposed that division of labour naturally degrades the labourer. Bowen,[1] for instance, writes: "The advantages of Division of Labour, one must admit, are subject to one serious drawback. Few things tend so effectually to dwarf the mind and stunt the faculties as the incessant and long-continued repetition of a very simple task—a mechanical movement which is repeated with as little effort of thought as if it were performed by a machine." The same objection has been crystallized in a *mot* of Lemontez: "It is a sad account for a man to give of himself that he has spent his life in opening a valve or never made anything but the eighteenth part of a pin."

Mr. Ruskin has expressed the same idea at greater length. "We have much studied and much perfected of late the great civilized invention of the

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[1] *American Pol. Econ.*, p. 51.

division of labour; only we give it a false name. It is not, truly speaking, the labour that is divided, but the men:—divided into mere segments of men, broken into small fragments and crumbs of life; so that all the little piece of intelligence that is left in a man is not enough to make a pin or a nail, but exhausts itself in making the point of a pin, or the head of a nail. Now it is a good and desirable thing truly to make many pins in a day; but if we could only see with what crystal sand their points were polished—sand of human soul much to be magnified before it can be discerned for what it is—we should think there might be some loss in it also. And the great cry that rises from all our manufacturing cities, louder than their furnace blast, is all in very deed for this,—that we manufacture everything there except men; we blanch cotton, and strengthen steel, and refine sugar, and shape pottery; but to brighten to strengthen to refine or to form a single living spirit never enters into our estimate of advantages."[1]

How far these allegations are true theoretically or practically has never been fully examined. Chevalier passes by the difficulty on the other side; he simply says the workmen of Paris are as a matter of fact more intelligent than the country people. But this seems scarcely sufficient answer, and we may quote Adam Smith to the opposite effect on the comparative intelligence of artizans and agricultural labourers. It is well known too that sailors, fishermen, and mountaineers are far more intelligent than those of an equal rank who are not exposed to an environment so constantly changing. Here, I think, we have the clue to the right answer to the question. *Machinery of itself does not tend to develop the mind* as the sea and mountains do, but still it does not necessarily involve deterioration of general mental ability. Surely it must *pro tanto* be considered a blessing that the energy of the labourer is not exhausted in his day's work: that his thoughts are free to wander though his hands are tied: and that after his work is over he is not too exhausted to betake himself to mental improvement.

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[1] *The Stones of Venice*, II. ch. vi.

A more forcible objection might be drawn from the *physical* side. Bodily exercise is in itself beneficial, and labour-saving apparatus may be carried too far for the health of the labourer. The sanitary conditions under which machinery places the labourers certainly require the careful attention of the legislator. Take, for example, the carding process in cotton. "The operatives who had to carry it on showed the effect of the dust in their pale, emaciated faces and in the bronchial affections from which they constantly suffered, causing cough, anæmia, debility, and other formidable symptoms of pulmonary mischief."[1] Again, there are diseases and discomforts incident on the use of particular machines. These have to a certain extent been remedied by factory legislation and Government inspection, and above all by the development of higher notions of morality among the masters.

Thus it is clear that the use of machines though apparently labour-saving often leads to an increase in the *quantity of labour*; negatively by not developing the mind, positively by doing harm to the body.

II. Let us examine now the effects of Division of Labour so far as arising from machinery on the *reward* of the labourer. The acquired skill of a labourer partakes partly of the nature of capital, partly of monopoly; and in both respects the law holds, the greater the skill the greater, *ceteris paribus*, the reward. Hence it is important to examine how far machinery dispenses with technical *skill,* and how far it leads to its further development. It was pointed out in the first division of this essay that one of the chief causes of the industrial distress at the commencement of the century was the substitution of unskilled for skilled labour caused by the introduction of machinery: here I propose to consider the *statical* side of the same question, *i.e.* how far the present system of industry, with its great division of labour due to machinery, affects the skill of the workmen and thus their wages. I must confess that this is a part of the subject where I have been unable to obtain results as general and accurate as could be desired. Such an undertaking to be thoroughly carried out would indeed take years of research and practical experience of workshops.

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[1] Bevan, *Industrial Classes*, etc., p. 18.

That one of the tendencies of division of labour is to *simplify* labour has often been pointed out *à priori*, and an examination of some of our most important industries confirms this opinion. In the *textile* branches in particular this has occurred without exception, and the process is still going on. Abundant proof of this is to be found in *Industrial Classes and Industrial Statistics,* edited by Bevan (Stanford, 1877). In the *cotton*[1] trade, for example, we find this passage: "Here we see that while the development of self-acting machinery has diminished the employment of the more expensive kind of labour (males above 18), it has increased that of cheaper labour, such as females and children. The proportion of the different classes is thus:—

	1850	1875
Children	6·4	14
Males, 13 to 18	10·3	8
,, above 18	27·4	24
Females	55·9	54

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[1] P. 9.

Again in the *flax*[1] factories the increase in the number of *children* is shown by the fact that whilst in 1850 the proportion of children employed was 2·3, in 1875 it was 7. The employment of females is now 66 per cent. of the total. In *woollens and worsted*,[2] out of a total of 238,241, only 71,892 are males above 18. In *lace*[3] the majority of the workers are females, and the statistics show a great proportion of juvenile labour. In the *silk*[4] manufacture, out of a total number of workers of about 45,000, only 8,466 are males above 18.

Even in the manufacture of *boots and shoes*[5] we read: "Although mainly the occupation of a man, women have of late years largely found employment, owing to the universal use of the sewing machine, which can be applied to stiff leathers just as well as to the most delicate muslins." Here, if we may be allowed to make a slight digression, the question naturally arises, What has become of the males above 18? The same volumes of statistics show (pp. 1, 19, 23, 37, 67) that the large mining industries and foundries absorb a large number, while railway service and the army and navy employ the great mass of the rest.[1] As a subsidiary result, we may notice that the increasing subdivision of labour tends to a greater employment of women and children in employments to which they are adapted, whilst the men find occupation where greater strength and (at present) skill is required. That such a result is of great advantage to the labourers as a class cannot be disputed for a moment, especially if we consider the *family as the wages-receiving unit*; but still this does not settle the question under discussion.

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[1] P. 38.

[2] P. 57.

[3] P. 95.

[4] P. 82.

[5] P. 142.

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[1] Compare for later returns, Marshall's *Principles*, p. 335.

What we wish to discover is how far this simplification of labour has dispensed with skill considered as capital or monopoly. The supposition of some writers that no skill or intelligence is required by machinery is evidently untenable. The fact that in all trades the *masters prefer piece-work,* and the consequent *variations in the wages of workmen* (which are far greater now than in the time of Adam Smith), prove this. The following extracts from a letter I have received from Mr. Start, president of the Nottingham Cobden Club, will serve to illustrate this point:

"The use of a complicated *lace machine* may require years before an intelligent person may be said to have learnt it." Then he continues: "Take the *stocking frame*: I have known lads to learn the use of the stocking frame and to be able to compete with men in six or eight weeks, and I have known men who have worked at the trade for years and can scarcely get a living. I know at this time a case of four men working in one room, and one of the four does as much work as the other three, and earns and receives as much money as the other three."

Thus we see that as a matter of fact in many cases the use of even *simple machinery* involves both technical skill and general intelligence. Still there is no doubt that the introduction of machinery has, in the industries examined above, led to less skill being required, and that in these employments labourers are so far relatively worse off than before.

But with increasing simplification of labour in some branches of manufacture, there has been increasing *complexity* in others. For instance, the making of machines and tools has become an important industry employing thousands.[1] On this point I would refer to an article in *Capital and Labour*,[1] quoted from the *Scientific American*. The writer, while allowing the fact that in the majority of cases the use of special machines requires far less skill than the same special work done by hand, asserts that in many cases just as great skill is required, for instance in the use of the axle lathe, and in putting together the parts of large machines. Again, it is important to notice that machinery cannot do *repairs*; the utmost it can do is to work on the plan of "interchangeability of parts."[2] Repair-shops for this reason are in general demand, and in view of the necessity which calls for the highest manipulative skill,

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[1] In England and Wales, between 1871 and 1881 the

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number of *makers of machines* increased 28 per cent.—up to 160,797. The total number working and dealing in machines and implements in England and Wales (1881) was 267,976, almost exclusively males.

[1] *Cap. and Lab.*, iv. p. 65. Issue of March 7, 1877.

[2] Compare Marshall's *Principles*. p. 315.

they generally contain the best of workmen who are paid the highest rates of wages.

Thus we see that the Division of Labour caused by Machinery has two opposite tendencies: on the one hand it leads to simplification of labour and loss of skill, and on the other it involves in some branches far greater skill than before. Contrary to what might be expected *à priori,* experience shows that *on the whole far greater skill is required now than formerly.* This is shown by the importance now attaching to *Technical Education,* an importance never before felt. It seems to be the unanimous opinion of competent observers that England must be eventually undersold unless she adopts a system of industrial education similar at least in its effects to that of France and Germany. In Mr. Twining's work on *Technical Training,*[1] the summary of opinions of men such as Prof. Tyndall,

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[1] *Technical Training.* Introduction, p. xv.

Sir L. Playfair, and M. Arnold seems to be sufficient to prove this, and Mr. Scott Russell,[1] in a work on the same subject, asserts that England is the worst educated country in the civilized world, and draws the same conclusions as to the prospects of our industries unless this state of things is altered. The same writer[2] enumerates in three tables the classes for whom systematic education is an industrial necessity. In the first table, in which the education might be called professional, there are 25 sub-classes, in the second we have 21, and in the third 18. In the last two we have included nearly all the industries of the nation.

Thus to assume, as some writers have done, that the use of machinery on the whole dispenses with skill is false as a matter of fact and productive of most pernicious consequences. The error has probably arisen from comparing without sufficient care the labour required in some of the textile trades at present with the skilled labour of former times required in those branches. The point will be further discussed under "Machinery as affecting foreign trade."

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[1] *Systematic Techn. Educ.*, p. 4.

[2] *Ibid.*, p. 9.

NOTE.—This account of the effects of machinery on skill stands as written in 1877. It is gratifying to find that since then technical education in this country has made considerable progress. Compare Marshall's *Principles*, pp. 268–270; and on the general increase of skill, see the essay by Mr. Giffen on the "Progress of the Working Classes" (*Essays on Finance*. Second Series).

CHAPTER IV.

MACHINERY AS AFFECTING THE CONCENTRATION OF LABOUR AND CAPITAL.

THAT the division of labour involved in using machinery necessarily leads to *concentration* of industry, was first distinctly shown by Babbage[1] in his chapter on the "Causes and Consequences of Large Factories." What Babbage proved only theoretically, has since been amply verified by experience. Take, for example, the cotton industry: "To show how much more relatively productive factories are now than they were formerly, the proportion of spindles was 10,857 in 1850 to 14,130 in 1875, and of power-looms, 127 in 1850 to 174 in 1875. This proves that the *factories* in the last quarter of a century have been *augmented in size*, and there has been a tendency to *concentrate machinery* in one mill, and also that machinery has become more and more self-acting and requires less manual labour."[1] Similar results hold of flax and wool.[2] Wool is made into stockings and carpets in the same factory, and I have been informed of cases in which the india-rubber required for the combs for carding wool is prepared in the same manufactory.

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[1] *Econ. of Mach. and Manuf.*

The concentrating influence of machinery is also illustrated in the increasing size of steamers, and by the fact that farms tend to increase in size, through the use of expensive machinery. The gradual extinction of small industries, in cases where machinery is employed and the demand extensive, has been so fully described by Porter,

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[1] *Industrial Classes*, p. 9.

[2] *Ibid.*, pp. 37. 58.

Young, and Brentano, that it would be pedantic to dwell further on the point. A striking confirmation of the law is afforded by America.[1] Massachusetts and Rhode Island, two manufacturing states, with a population of only 1,405,686, have nearly as large a civic population as ten agricultural states with an aggregate population of 10 millions.

There is, however, another tendency of an opposite kind, which has been generally overlooked: Brentano,[2] for instance, asserts that it is the tendency of all industries more and more to fall into the hands of a few capitalists. The counteracting tendency I allude to, arises from the increasing wealth of all classes of the community, chiefly due to machinery, giving rise to a vast number of *small industries*.

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[1] Bowen, *Amer. Pol. Econ.*, p. 78.

[2] *Englische Gewerkvereine*, ii. 336.

The man who can invent a new luxury is sure of large and immediate profits. For instance, the discovery of a new dye, or the invention of new ornaments or toys, may be the foundation of a new industry. And, in fact, instances are not wanting of entirely new trades springing up. All luxuries are, as a rule, produced on a small scale; the best fishing-rods and golf-clubs are made by particular makers in private workshops, and the arts of photography and pattern-designing illustrate the tendency. Again, the number of professional men has largely increased. The importance to a country of having a varied industry is very great, and there seems to be no reason why there should not exist in England, for example, as great a variety of small industries as there was formerly, side by side with the immense capital which is required in the factory system.

To return from this digression, it must also be remarked that there is a further tendency of large factories to be concentrated in *large cities*. Our manufacturing towns have grown *pari passu* with our factories; this is proved by tables in a convenient form by Jevons,[1] who adds, "our manufacturing population has more than quadrupled in sixty years."

Taking it for granted, then, that machinery tends to concentration of both capital and labour,—in other words, to the increase of factories and towns,—we have now to examine the results of this concentration on wages. Here, again, it will be most convenient to consider the question (i.) in relation to *quantity of labour*, (ii.) in relation to *reward*.

I. The evils which characterized the introduction of large factories, and the sudden growth of towns, have been already discussed under "Substitution,"[2] and it is only necessary here once more to lay stress on the legitimacy of the interference of the legislature, in compelling the masters, to some extent at least, to consider the sanitary and mora conditions under which their people work. That Government interference was necessary, is shown by the fact that France and Germany have found it expedient to follow the example of England. Still, whatever legal precautions are taken, it is clear that the *quantity of labour* required to do a certain amount of work can only be reduced to a minimum by the growth of higher moral principles. The *relation between masters and men* is very different under a small system of production and a large. To a large manufacturer, unless he be a highly sympathetic man, his work-people tend to become mere *A*'s and *B*'s of an economic problem, embodied forces, which can raise so many foot-pounds, or "do" so much "work." The use of the term "hands" is suggestive of Aristotle's remark, that a slave is an animate tool, and a tool an inanimate slave, and that no friendship can be between masters and slaves.

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[1] *Coal Question.*

[2] Ch. i.

Apart from this concentration in factories, the concentration in *large towns* has at first a pernicious effect on the workman. No doubt there are advantages connected with life in cities. Education may be carried on to a greater extent than in the country, and many comforts may be obtained, which a scattered population must do without. But to preserve or cultivate independence of mind and vigour of understanding is far more difficult: still more difficult is it to develop æsthetic emotions. Take, for instance, the old ballad literature of England, and compare it with the music-hall productions which have taken its place. Still it may be replied that "operatives" are in every way better off than the agricultural labourers, and this is certainly true at the present day. All I wish to point out is, that to live well in a large city requires far more conscious rational action, and no doubt this will in the end serve to develop a better system of morality and habits of life than it displaced; but the history of all large cities warns us, that the social problems involved in their very existence demand for their solution earnest thought and life-long devotion.

II. But it is necessary to examine more particularly the effect of concentration on the *reward* of the labourer. The genial relations between masters and men, which under the old system had become fixed by law and custom, gave place, on the introduction of machinery, to a struggle of power. To this fact, as Brentano has most clearly shown, was due the origin of *Trades-Unions*. The principle of their action briefly stated is, that wages shall, so far as the labourer is concerned, be fixed by large masses of men, not by individuals, and it is to the concentration of labour and capital that they owe all their power, and, as the labourers would say, the necessity of their existence.

Trades-Unions again have given rise to a further widening of the gulf between employers and employed. The masters in their turn have answered combination by combination. The consequence is that when prices begin to fall, the masters begin to reduce wages; when prices rise, the Unions, whatever their professions, demand a rise of wages: and thus the market value of labour has a price, like every other commodity. Lord Brassey[1] maintains that "the labour market is sensible to every fluctuation of trade." It may be true, as Brentano asserts, that what the leaders of the Trades-Unions desire is a *steady sufficient wage*, but with the concentration of labour and capital now dominant, owing to machinery, this seems impossible.

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[1] *Work and Wages*, p. 78.

This result is so important, that it may be well to show how it follows, by treating the question from another point of view. It is well known that all large manufacturers carry on their business, to a great extent, on borrowed capital, by discounting bills when trade is good. It has however been forgotten, that just as surely as modern industry requires a large mass of *floating capital* on which it may draw in case of need, so also it requires a large amount of what may be called *floating labour.* In the very birth of large industries, "the opulent clothiers made it a rule to have a *third more men than they could employ*, and these had to stand still part of their time."[1] And this is partially the case now: in all large industries the number of hands in full work is never the same for any length of time.[2] And unfortunately for the labourers, they cannot separate themselves from their labour; capital is cosmopolitan, but however much the mobility of labour may be increased, it can never approximate to the mobility of capital. What Adam Smith said is true now, and always will be true—"man is of all baggage the most difficult to be transported."

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[1] Brentano, *Gilds and T. U.* Eng. edn., p. 109.

[2] Compare p. 65, *note.*

NOTE.—In the original edition a criticism was introduced on co-operation for production as a remedy for industrial strife. Although it may be shown by statistics that co-operative production forms a very small part of our industrial system, and has often failed, I am reluctant to say anything adverse to a plan which is morally so attractive. Besides, the subject, with the allied subject of Profit-Sharing, is too large for adequate discussion in this essay. See my article in the *Contemporary Review*, January, 1890.

CHAPTER V.

MACHINERY AS AFFECTING THE MOBILITY OF CAPITAL AND LABOUR.

The mobility of capital and labour depends on two factors, (*a*) *means of transport,* (*b*) *knowledge of markets.* Both of these elements have been influenced by machinery, and have in turn had important effects on wages, as has already been shown by implication in the previous divisions of the subject. Let us now consider how machinery has affected the two factors above mentioned.

(*a*) The effect of machinery in *facilitating transport* may be illustrated by comparing the means of communication existing at the present time between Preston and Wigan, and those which were available when Arthur Young made his Northern Tour, one hundred years ago. "I know not," he writes, "in the whole range of language, terms sufficiently expressive to describe this infernal road. Travellers will here meet with ruts, which I actually measured, four feet deep, and floating with mud only from a wet summer; what, therefore, must it be after a winter?"

That the improvements in the methods of transport have been to a large extent taken advantage of, is proved by the astonishing results of Dr. Engel's calculation, quoted above, that *three* times as much horse power is used in *locomotive* as in fixed engines.

(*b*) The effects of machinery in accelerating and promoting the *diffusion of knowledge requisite to mobility,* are no less evident and startling. Steamers and railways make an "organized market" of the civilized world. The mail service in the remotest part of the country is better than it was, before the era of machinery, in the most densely populated district. Not content with availing themselves of the ordinary trains, newspaper proprietors run special trains for their own business. A printing press is in itself a wonder of mechanism, compared with its progenitor of some fifty years ago. Without steam and improved machinery, no daily paper could print a sufficient number of copies to satisfy the demand. Again, the *telegraph* is a system of machinery which has still further increased the organization of markets. The greater part of machines at this time use steam as a motive power, so that there is a tendency to confine the use of the term to steam engines and their direct applications, but this is altogether unjustifiable. The telegraph is, in any scientific sense of the term, machinery just as much as the power-loom. Babbage, in his standard work, which may in this subject be called a "classic," gives as the chief characteristics of machinery, that it *saves labour and saves time.* The telegraph does both, and being a mechanical construction, comes under the denomination.

Mobility is an economic term of very wide application, and particular cases have already been discussed. When machinery was substituted for labour, the only remedy we discovered was change of place or occupation,[1] and again we saw that the possibility of a glut is due to want of organization. It is clear that in these cases any improvement in mobility is of service directly to capitalists and labourers alike. But wages and profits are *correlative* terms, and both depend on prices.[2] Hence, one of the most important factors in determining wages is the RELATIVE *mobility of labour and capital,* especially that part of both which has above been termed "floating."

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[1] Cf. *ante*, Division of Labour, iii.

[2] Cf. *ante*, Introduction.

I. First then, *in obtaining information*, how far has the progress of invention aided the capitalist in comparison with the labourer? The extreme complexity of the problem of mobility has in general been overlooked. The ordinary deductive school seems to think the problem is solved by merely quoting an axiom on which the solution is in part founded. If, it is said, wages and profits are higher in one place than another or in one employment than another, the capital and labour will rush in and bring them down to the ordinary level by competition. That there is such a tendency in modern industry is, I take it, self-evident, but the law of its action is by no means so clear.[1] We may take an analogy from another science, which like Political

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[1] Cf. Cliffe Leslie, "Course of Agricultural Wages in Europe." *Fortnightly Review*, June 1, 1874.

Economy is in its infancy: I allude to Meteorology. The ordinary teaching of the old Physical Geographies is that if the atmospheric pressure is lower at one place than another, air will rush in, and calm will be restored on the equalization of pressure. But in practice, it is not a certain deduction that a south wind is blowing because the weather charts inform us that the barometer is higher in London than in Edinburgh. We must consider not merely two points but a wide area, and the whole theory of cyclones and anti-cyclones. So it seems to me that the tendency to equality of profits stands to the phenomena of fluctuations in industry in the same relation as the tendency to equalization of atmospheric pressure does to the phenomena of storms: neither is an explanation, but rather an assumption or axiom on which an explanation may be based. Ricardo's farmer does not take to making cloth because cloth-makers are getting high profits. Why should he? Why not to any other of a thousand industries if they too are getting higher profits? Why not devote his capital to all equally? For this same reason, that if the barometer at Edinburgh is higher than anywhere else, it does not follow that a gentle breeze is blowing from that city to every point of the compass.

To return then to the question how far the new modes of obtaining information introduced by machinery have altered the *relative* positions of capital and labour, it is, I think, clear that the capitalist has gained by far the most. *Of all markets the labour market is the least organized.* In other markets the future is considered as much as the present. The rumour of a war, the possibility of a bad harvest, a change of ministry, and a multitude of similar facts are all discounted by the capitalist, and though they have just as important effects on wages, hardly one of them is considered even by the most intelligent workmen before its effect is felt. Thus Capital has taken full advantage of its increased means of obtaining knowledge, Labour scarcely at all.[1]

II. If again we consider the *improvement in transport,* we shall find the same result. Capital passes rapidly from one place to another, and unless locked up in plant, from one employment to another. It does not matter to the capitalist in the least where his manufactured articles go : China or Peru is all the same to him. Again, commodities are sold once for all as far as he is concerned : the labourer must always carry his labour with him.

Thus we see in taking advantage alike of improved means of obtaining knowledge and of transport, Capital has been favoured far more than Labour. It was pointed out under "Substitution"[1] that improvements tend to become continuous, and that Labour might fairly hope to attain to sufficient mobility to adapt itself to the *gradual* changes. In this case the improvements in locomotive and what I may term *organizing machinery* continually add to the adaptability of Labour. But in the case before us, *i.e.* if capital be *more mobile* than labour, it is clear that the labourers are so far *worse off* than they were before. If floating capital can be readily transferred to places where it is wanted, the wages-fund theory applied to a particular industry falls to the ground in its most essential part. The only part of it which holds good—that part which considers the number of labourers as *fixed* for a particular trade and time—points inevitably to the conclusion that in fluctuations of industry the labourers are at a disadvantage.

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[1] The bureau of industries in New Zealand is an interesting experiment. See *Board of Trade Journal*, Feb., 1892, p. 165.

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[1] P. 33.

The rationale of fluctuations in prices and wages can only be properly completed by discussing *International Trade.* It would be out of place to examine the question here at length, but the general effects of machinery on international trade are so important in their reaction on wages, that an outline of the effects seems necessary to complete the plan of this essay.

The changes effected by machinery are partly due to those characteristics discussed under the heading "Auxiliary," partly to those under "Mobility." The result may be summed up in a sentence. Machinery has enabled England to turn out a sufficient amount of certain articles for the markets of the world, and machinery of a different kind has enabled her to distribute this enormous produce. Partly through being the first to adopt the new processes, partly through the greater enterprise of her capitalists, English manufacturers at first monopolized the markets. This monopoly led to large profits in the first place, and consequently to the greater employment of labour and capital in a few important manufactures (cf. Porter and Jevons). Our agricultural population has steadily diminished, and our imports of necessaries have steadily increased, all this century. It is calculated that at least two millions of people depend directly or indirectly on the cotton industry alone.

The important thing to notice is that what rules "international trade" is Reciprocal Demand, and this demand again depends on a multitude of variable elements. The imposition of a protective duty or any new tax by a foreign country may throw an industry into a state of depression; with a crisis the pressure may become extreme, and with a war the industry may be utterly ruined.

And not only are our markets liable to fluctuations from demand, but it must be observed that our raw materials are for the most part of foreign growth, and that coal and iron, the necessaries of machines, are of limited extent. With the cotton famine not yet forgotten, and the increased rise in the price of coal after the Franco-Prussian war fresh in our memory, it is superfluous to give further illustration. The conclusion from this point of view is manifest: *machinery has given rise to more sudden and extensive fluctuations, and to greater precariousness of labour, than was the case in a simpler and more stable state of society.*[1]

This result may seem to contradict an opinion generally held that foreign trade by increasing the number of markets tends to steady prices. The danger of depending on *one* foreign market has been forcibly stated by Adam Smith[2]:—"The industry of Great Britain, instead of being accommodated to a great number of small markets, has been principally suited to one great market. Her commerce, instead of running in a great number of small channels, has been taught to run principally in one great channel; but the whole system of her industry and commerce has thereby been rendered less secure, the whole state of her body politic less healthful than it otherwise would have been. In her present condition Great Britain resembles one of those unwholesome bodies in which some of the vital parts are overgrown, and which upon that account are liable to many dangerous disorders scarce incident to those in which all the parts are more properly proportioned. A small stop in that great blood-vessel which has been artificially swelled beyond its natural dimensions, and through which an unnatural proportion of the industry and commerce of the country has been forced to circulate, is very likely to bring on the most dangerous disorders upon the whole body politic. The expectation of a rupture with the colonies, accordingly, has struck the people of England with more terror than they ever felt for a Spanish Armada or a French invasion."

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[1] Compare, however, p. 65. [2] P. 272 (McCulloch).

This opinion—that the greater the number of markets the greater the steadiness of price—seems to me to be only true under certain conditions, conditions which are liable to be disturbed.

The enormous development of steam communication and the spread of the telegraph over the whole globe have caused modern industry to develop from a gigantic star-fish, any of whose members might be destroyed without affecting the rest, into a *μέγα ζῶον* which is convulsed in agony by a slight injury in one part. A depression of trade is now felt just as acutely in America and even in our colonies as at home. Still in the process of time, with the increase of organization and decrease of unsound speculation, this extension of the market must lead to greater stability in prices, but at present the disturbing forces often outweigh altogether the supposed principal elements. Another danger, to which our merchants are continually calling attention, attends the dependence of our industry on foreign markets. England may be *undersold.* Against this there is one remedy which is entirely in our own power. Many capitalists cry out against Trades-Unions and assert that they will ruin our industries. The adequacy of the cause to the effect does not appear very evident, and the real danger is overlooked. Attention has already been called to the importance of *technical education,* and if we are undersold, the contemptuous neglect which Englishmen compared with foreigners still appear to entertain for this means of increasing the efficiency of labour, will be far more to blame. The whole question is most fully discussed in Mr. Scott Russell's work on *Systematic Technical Education*, ch. iv. In this chapter is given a summary of the opinions of the most celebrated men, representing learned professions, applied science, engineering, education and manufacture. It is to be hoped that the opinion expressed by Mr. Samuelson, M.P., is warranted when he says, "To the evils of such a condition not only our statesmen but also our people are rapidly awakening, and the disease once acknowledged, the remedy will soon be applied." This statement is certainly borne out by the action of men like Mason and Whitworth and the members of the City Guild, and that the working classes are not insensible to the want is shown in the same work.[1]

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[1] Scott Russell, *Syst. Tech. Educ.*, pp. 101, sqq. See also the Report of the Commissioners on Technical Education (1884).

Our race, climate, and insular position, are guarantees that the process of underselling will not be very speedy, provided only we increase the efficiency of our labourers; and the organization—if I may use the phrase—the democracy of our capital gives us advantages which other nations will take years to surpass.

SUMMARY OF RESULTS.

The complexity of the problem and the method adopted of regarding the question from different points of view render it necessary to present in outline the results obtained, to compare generally the good and evil effects of machinery on the welfare of the labouring classes in the past and present, and, peering a little way into the obscurity of the future, to consider what prospects there are of the evil being eliminated and the good increased.

In the *introductory remarks on wages* an examination of the terms reward and quantity of labour led to the rejection at once of the method of comparing prices and nominal wages at different times as giving any criteria of "real" wages. "*Quantity of* *labour*" was defined in a similar way to that adopted by some German writers as equivalent to "expenditure of life-force": *reward* received a definition equally broad, as including all the desirable things accruing to the labourer in virtue of his position as such. With these definitions it followed at once that it was impossible to give any simple law for the determination of wages, and an examination of the term *Machinery* led to the conclusion that machinery (defined historically, not abstractly) might influence wages in many different ways.

I. The *immediate and proximate* effects of the *substitution of machinery for labour* were first examined;—those effects which are due to the *transition* from one system to another. The *sudden* introduction on a *large* scale of labour-saving machinery has always been considered an evil, but the evil varies with the suddenness and the extensiveness of the change on the one hand, and *the extension of the market* and *the mobility of labour* on the other. I attempted to show that both the *invention* and *adoption* of labour-saving machines tend to become more *continuous*, the increments of change becoming smaller. And it is clear under these conditions that if there is any extension of the market on the reduction of prices effected by introducing machinery, the labourers may not be injured even temporarily. Still it was admitted that discontinuities would always occur, and then the only remedy appears to consist in increased mobility of labour.

The preceding is the simplest case of the problem, and of comparatively small interest and importance compared with the consideration of the complex *social* results which ensued on the introduction of large factories. The old *relations between masters and men*, which had become comparatively stable by law and custom, were suddenly thrown out of gear; *skilled* labour of a certain kind was replaced by unskilled; the skill which was required was *not embodied in the same workmen* as before; and finally the conditions, physical, intellectual and moral, in which the labourers were now compelled to work, led to a fearful *degradation of labour*. These results, it may be said, are by no means matured, even at the present day. The relations between masters and men are not by any means in a satisfactory condition; technical education (in England at least) is only in its infancy; and although factory legislation has done a great deal, the conditions of work in large industries are still capable of vast improvement: in a word, *industry has not yet adapted itself to the changes in the environment produced by machinery.*

It was noticed as a subsidiary result that sometimes the labourers had succeeded in obtaining for themselves all the advantages caused by the improved machinery, that labour-saving machinery had, in certain instances, led to a *reduction of the working hours*, and of the *quantity of labour.*

II. The remainder of the discussion was mainly devoted to the examination of the *statical* side of the question, though of course it was not pretended that the two questions can be discussed quite separately.

(1) Considering the effects of the enormous increase in the productive power of labour caused by *machinery as auxiliary to labour,* we saw

(*a*) That the working classes were benefited with the rest of the community by the increased cheapness of manufactured articles ; that this fall of price of commodities constituted a *rise in real wages.* (β) That the accumulation of capital was increased, and consequently *the demand for labour.* (γ) Against these advantages it was proved that the use of machinery tends to *excessive hours of labour* ; and statistics were adduced to show that this allegation against machinery is not a mere offspring of the imagination. This evil has, however, been remedied to a great extent, partly by law, partly by custom. (δ) Another danger inherent in the use of productive agents of such power as those now in vogue consists in the possibility of *over-production in relation to the means of organization.* Here it seems to me we have one of the most important effects of machinery. Wages are liable to fluctuations such as were not experienced under the system of small industries, and are more precarious. Against this evil modern industry is still badly armed, and in the meantime all the labourer can do is to save when wages are high, so as to be prepared for a fall.

(2) The effects of machinery on *Division of Labour* were next considered, with the following results:

(a) *Quantity of Labour* (or stress of toil) seems to have been *increased* in many employments by the increased division of labour consequent on the use of machinery, not however so much on the mental side, as some writers have maintained, as on the *physical*. (β) The use of machinery allows of a *better distribution* of labourers than formerly. Women and children find suitable employment in light work, whilst males above 18 devote themselves to industries requiring greater energy. (γ) The fact that masters all prefer piece-work, and actual statistics of the difference in wages in the same employment, with other considerations, were adduced to show that even in the use of simple machinery *skill and general intelligence are required still more than formerly*. (δ) In connection with more complicated machinery the importance of *technical education*, by the aid of which the workman might hope to take a position equal if not superior to the small master of earlier times, was insisted on, and at the same time it was pointed out that the only safeguard, in case of the destruction of his *fixed skill* by new improvements, lay in the *general* cultivation of his intellectual and moral faculties.

(3) The effects of machinery in *concentrating labour and capital* were then examined:

(*a*) It was proved both theoretically and historically that concentration naturally follows division of labour, though at the same time, in a short digression, attention was drawn to the fact that increase of national wealth consequent on the use of machinery naturally leads to the development of a number of *small industries.* (*β*) The evils inherent in the system of large industries, and the consequent life in towns, so far as *quantity of labour* is concerned, were weighed, with results lamentable in the past, doubtful for the present, but promising for the future. Here again the necessity of legislation became apparent, and above all the development of a higher morality in both masters and men. (γ) As regards the *reward* of the labourer, we saw that it was liable to severe *fluctuations* owing to the employment of a large amount of *floating* labour and capital. (δ) The question was then considered whether the workmen could hope to avoid these fluctuations; and it was shown that the action of *Trades-Unions*, whatever their professions, intensified the effects last noticed and caused *wages to vary with prices* still more exactly, and this, it was remarked, is in reality equivalent to saying that the labourers *get a share of the profits.*

(4) Here it was natural to make a transition to the general question of *mobility of labour and capital*, as affected by machinery.

(*a*) This mobility was shown to depend on two factors, *knowledge and means of transport*; and facts were brought forward to show that both elements had, through what was called *locomotive* and *organizing* machinery, been enormously developed. (β) The effects of this general development having by implication been noticed before, attention was directed to *the relative mobility of labour and capital,* and it was shown that, to the disadvantage of the labourer, *capital had gained* in both particulars *more than labour,* the labour market being less organized than any other, and man the most difficult baggage to transport. (γ) The special case of mobility in connection with *international trade* was then briefly examined, especially in relation to *fluctuations of wages*; and here again serious dangers to the labourers became manifest. (δ) The dangers of being *undersold* were then considered, and once more the importance of *general and technical education* became evident.

Such are the particular results for the particular era considered. These results have justified the method adopted, according to which it was said at the outset that a general answer applying to all times and places was impossible, for the answer must depend on the systems of industrial organization, law, and morality dominant in the society we wish to consider. That every accession to man's empire over Nature *may* be productive of good to mankind at large no one will deny; but we must never forget that any increase in the material forces at our disposal involves an increase of intellectual and moral energy. "The state of every part of the social whole at any time is intimately connected with the contemporaneous state of all the others. Religious belief, philosophy, science, the fine arts, commerce, navigation, government, all are in close mutual dependence on one another, insomuch that when any considerable change takes place in one we may know that a parallel change in all the others has preceded or will follow it."[1]

If this be true, it is clear that an abstract treatment of the commercial conditions apart from the rest can lead to no trustworthy results. But restricting the answer to the Era of Machinery which we have here considered, a comparatively *general* result may be given.

The past. In reference to *the past,* for fifty years after the introduction of the improved processes of production which marked the commencement of the era, the working classes instead of benefit undoubtedly received injury. The civilized nations, England in particular, had developed forces they could not control; the established laws and usages fell into desuetude, and there followed a general disorganization of industrial society.

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[1] Mill's *Auguste Comte and Positivism*, p. 87.

The present. Though many advances towards stability have been made, the severe fluctuations in trade, the strikes and lock-outs,[1] the recognised defects in the sanitary conditions of work, all point to inadequate adjustment even in *the present.* The process of adaptation to the new environment has been rendered less speedy than it might have been by the absurd extremes to which the doctrine of *laissez-faire* has been carried. This dogma, first enounced at a time when the laws affecting industry were so bad, that the greatest licence conceivable would have been better, was naturally received with great favour; it was supposed to be perfectly verified by the success of Free Trade; and has since been supported by a misinterpretation of the theory of evolution. Under the influence of this theory the followers of Mr. Herbert Spencer feel inclined to trust to "survival of the fittest" to bring about the best state of things possible. But this is trusting to the lower instincts to do what Reason, "the highest of all instincts," is unable to perform; it is an optimism more degrading and less justifiable than the fatalism of enervated Orientals.

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[1] According to Mr. Burnet's Report of the Strikes and Lock-outs of 1890 (the last return to hand), there were in that year 1,023 strikes, and the loss to the nation was equal to 19·88 days' work by 373,650 persons.

As Aristotle says:—"Law possesses a compulsory power, since it is reason proceeding from a certain prudence and intelligence; and the law is not odious when it prescribes what is good." Yet even now, instead of regarding law as the highest product of progressive societies, some people seem to imagine legislation is a return to tyranny or paternal government.[1]

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[1] I confess that at the present time (1892) I do not think the utility of reliance upon Law and Government needs the emphasis it required in 1877.

In the words of James Martineau:[1] "Two methods exist of aiming at human improvement: by adjusting circumstances without, and by addressing the affections within; by creating facilities of position, or by developing force of character; by mechanism or by mind." Although "mechanism" has done much, and this has been fully insisted upon, still I maintain that both Law and Morality, the influences affecting "force of character," must make great advances in *the future* before the working classes obtain all the benefits improved machinery renders possible.

The future. The practical importance of the subject prevents us from resting content with indicating the probable effects of elements now existing, but compels us to inquire what new elements we should consciously strive to introduce in order to attain this end.

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[1] Quoted in J. Yeats, *Technical History of Commerce*, p. 430,

I. First of all, then, let us glance at what remains for governments to perform. If it is taken for granted that we have reached the limits beyond which legislation on sanitary conditions is not needed; if we suppose that the recent act on the liability of employers for the injuries received by their workmen is, as Harriet Martineau would say, "the result of a pseudo-philanthropy which is one of the disgraces of our time"; if we suppose that no further laws on the employment of women and children are required; still with all this, there are important matters which demand the consideration of governments.

(1) In the first place, a better scheme of *general and technical education* is necessary. In respect to general education, taking the words in their narrowest signification, something has already been done, but technical education is still left to competition and survival of the fittest. And yet,

as Mr. Twining [1] writes after the fullest examination of the subject, "For giving our national industries a rate of progression equal to that of the age, no less motive power will suffice than that of an institution on a national scale effectually supported, or still better, actually constituted, by Government." Again, the patent laws are in a chaotic condition, and yet it would be a great advantage to the nation if artizans were enabled to reap some of the fruits of their invention. Further, nothing is more destructive of the energies and the morality of working men, than for them to imagine they are bound down by iron chains in the lowest grades of a modern caste system. It is no doubt true that there must always be hewers of wood and drawers of water, but no state of society can be considered incapable of improvement in which facilities are not offered to the best specimens of the lowest class to rise to any occupation for which they are adapted. Even Plato with all his aristocratic leanings admitted that if a golden child happened to be born of iron parents, he should be allowed to pass into the rank intended for him by Nature. It is clear that without a national system of education this promotion, except in rare cases, is impossible.

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[1] *Technical Training*, p. 49.

(2) The New Era involves radical changes in *international policy*. It is a curious fact that Political Economy in its most rudimentary state arose from international relations. "In order to understand what a market originally was, you must try to picture to yourselves a territory occupied by village communities, self-acting, and as yet autonomous, each cultivating its arable ground in the middle of its waste, and each, I fear I must add, at perpetual war with its neighbour. But at several points—points probably where the domains of two or three

villages converged—there appears to have been spaces of what we should now call neutral ground. These were the markets."[1] The writer goes on to remind his readers how the Roman Jus Gentium, the foundation of modern International Law, was in part originally a Market Law. It is no less true, in these days, that Political Economy in its most important aspects—that is, when it attempts to solve completely practical problems—involves the study of international relations more highly differentiated. The doctrines of value, foreign trade, and by consequence the most important parts of the theory of taxation, manifestly rest on the relations subsisting between different countries; capital has long since become cosmopolitan, and wages current in any one country are intimately connected with events occurring in different parts of the world. What direction legislation in these matters should take, it would be presumptuous to discuss in a superficial way at the conclusion of an essay on a special subject. Still attention may be drawn to the fact, that international relations are far behind the wants of the age. No one would recommend a return to a policy of isolation with an improved "balance of trade." Still we see every day a further organization of capital and labour,—we see one country, notably our own, permitting the existence of its industry to depend on the passions of other nations, and with no security that a quarrel which it does nothing to originate may not lead to the destruction of its commerce and the misery of its inhabitants.

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[1] Maine, *Vill. Comm.*, p. 192.

II. But if there is much left for law, there is wanting, still more, a higher development of *morality*. "Legislation has nearly expressed its inability to keep pace with the activity of man in discovery, in invention, and in the manipulation of accumulated wealth; and the law even of the most advanced communities tends more and more to become a mere surface-stream, having under it an ever-changing assemblage of *contractual* rules with which it rarely interferes, except to compel compliance with a few fundamental principles, or unless it be called in to punish the violation of *good faith*."[1]

Men have a natural disinclination to regard morality as advancing; they seem to imagine that the morality of one age is perfectly adapted to the wants of another. But morality has advanced undoubtedly, and this development must be fostered now more than ever.

Theoretically many equally plausible schemes of distribution may be maintained; but these are the days of machinery and large capitals, and I cannot but think that if speculative philanthropists like the Social-Democrats would endeavour to remedy the defects of the present edifice rather than attempt a new construction on its ruins, they would probably do some practical good in the present, and at any rate they would, in case of failure, have the intellectual consolation of feeling assured that by this method alone has any veritable progress taken place. Much good might be done to the working classes if a higher standard of morality and of life were set before them: as the motto at the head of this essay states:—The Wages Question is a question of Culture—using the term in its best and broadest sense.

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[1] Maine, *Ancient Law*, p. 305.

"It is not enough that by a decrease in the hours of labour actual hindrances in the way of the elevation of the working classes have been set aside. It is necessary that still more than ever positive contrivances and methods of culture should be created, in order to throw open to the working classes the benefits of the progress of mankind in civilization."[1]

And in the masters no less than in the men, higher notions of morality are requisite. It is not denied that England can boast of many merchants who are fully alive to the social requirements of the day, and who have hearts that respond to the appeal. There is, however, still room for the moral necessities of the age to be impressed upon our capitalists, whether by the calm historical method of Brentano or by the passionate vehemence of Carlyle.[2] "The leaders of industry, if industry is ever to be led, are virtually the captains of the world; if there be no nobleness in them, there will never be an aristocracy more . . ."

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[1] Brentano, *Englische Gewerkvereine*, 2te Th., p. 339.

[2] Carlyle, *Past and Present*, p. 233.

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AND

ESSAYS

ON

MONETARY PROBLEMS.

BY

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